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DESIGN OF A SANITARY SEWER

SYSTEM FOR JEFFERSON,

WISCONSIN

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THE DESIGN OF A SANITARY SEWER SYSTEM FOR  
JEFFERSON, WISCONSIN

BY

GILBERT ALBERT DIESTLER

AND

GARRET EGBERT HERBINK

A THESIS SUBMITTED FOR THE DEGREE OF  
BACHELOR OF SCIENCE  
CIVIL ENGINEERING COURSE

UNIVERSITY OF WISCONSIN

1908





## DESCRIPTION.

Jefferson, the county seat of Jefferson County, Wisconsin, is located at the junction of the Crawfish and Rock Rivers, and on the Janesville Division of the Chicago and North-western Railroad, 120 miles north-west of Chicago, and 50 miles west of Milwaukee. The town is topographically divided into three districts, which will hereafter be designated by; 1st, East of the Rock River, 2nd, West of the Rock River, and 3rd, South of the Crawfish River.

During its early history a timber dam was built across the Rock River. This power served for a long time to operate lumber mills. It has since been divided as follows:  $\frac{3}{8}$  is at present used to run a grist mill, the remaining  $\frac{5}{8}$  being idle. The city is at present negotiating for the purchase of the latter to operate its water supply and lighting plant.

The business of the city is concentrated along Main Street, from Mechanics Street to Dodge Street, and along the several intersecting streets. The manufacturing industries occupy favorable positions on either bank of the Rock River, the principal ones being a tannery, chair factory, box factory, farm implement factory, brewery, two shoe factories, and two brickyards.

The water supply and lighting plant is owned and successfully operated by the city. The plant is situated at the foot of Racine Street, and consists of two 100 H.P. boilers, a



100 H.P. Allis-Corliss engine, and two 75 K.W. Royal alternating current generators. These furnish current to some 3,500 incandescent lamps for both public and domestic use. The source of the water supply is the Potsdam sandstone, pierced by an artesian well 842 feet deep. The water is pumped through the mains into a stand-pipe on the west side of the river, against a total head of 160 feet, by two Smith Valve pumps, each having a capacity of 125,000 gallons per day.

Jefferson is the county seat as well as the principal city in the county, and is well supplied with public buildings. The County Court house occupies a site on a public square, comprising the two blocks between Main and 3rd Streets, south of Dodge Street. The high school is beautifully situated on a prominent height on the west side of the river, overlooking the entire town. Last summer the building was partly destroyed by fire, and is now being remodeled and equipped after a more modern and elaborate design. Besides the several ward schools, two parochial schools strive to fill the ever-increasing demand for educational facilities.

The census for 1905 shows a population of 2,600 people. From a population curve we estimated that at the present rate of increase, the number of inhabitants thirty years hence will probably be 3,400; however, in designing this system we assumed that the population will reach 4,000.



The consumption of water ranges from 100,000 to 200,000 gallons per day. As the maximum consumption per capita per day we assumed 150 gallons.

The datum plane, as assumed for this work, lies 100 feet below the top of the hydrant at the north-east corner of Main and Racine Streets.

In all probability laws will be framed in Wisconsin in the near future prohibiting the pollution of inland streams by sewage. On this assumption we have so designed the system that all the sewage may be collected near the south-eastern limits of the town, at a point, which, considering its favorable topography, nature of soil, and low value, is, in our judgment, the most desirable location available for a disposal plant.

Unfavorable topography and the division of the town into three parts by natural water courses, offer serious difficulties to the design of a purely gravity system. In order to collect all the sewage at the proposed site of the disposal plant, the rivers must be crossed in three different places. Two of these crossings (as shown on the accompanying map) are to be made by utilizing existing pile bridges to support cast iron pipe lines. Since there is no bridge at the third point of crossing of the Rock River, and as the fall available at this point is insufficient for the



successful operation of an inverted siphon, some arrangement for raising the sewage to a higher elevation will have to be made. The arrangement recommended for this purpose is shown on the accompanying drawing. It consists of a well on the east side of the river, from which the sewage is to be lifted at intervals by a four inch vertical centrifugal pump, direct connected to a one horse power vertical electric motor. The arrangement is to be automatically regulated by a float connected with the starting apparatus of the motor.

The determination of size of pipe was taken from tables based on Kutter's formula, with a value of  $n = 0.013$ . The difficulty of laying a six inch pipe, and the increased danger of clogging, led to the adoption of eight inches as the minimum diameter. As minimum grade two-tenths of one per cent. was used.

The estimate of cost was based on a large number of current bids and contract prices for similar work in Wisconsin, Illinois, and Indiana.





## SPECIFICATIONS.

These specifications are for the construction of a sanitary sewer system for the City of Jefferson, Jefferson County, Wisconsin, and include all material, labor, and appurtenances.

### GENERAL SPECIFICATIONS.

#### INTERPRETATIONS:

DEFINITION OF "CITY." By the term "City" is meant the City of Jefferson, Jefferson County, Wisconsin, and its legal representatives.

"ENGINEER." Whenever the word "Engineer" is used herein, it shall refer to the City Engineer or one of his assistants, duly appointed by him for the particular work in question.

"CONTRACTOR." Whenever the word "Contractor" is used herein; it shall be understood to refer to the party or parties contracting to perform the work to be done under these general and detail specifications, or to the legal representative of such party or parties.

DRAWINGS. The several drawings herein referred to consist of plans, profiles, and cross-sections of the proposed work, and will be considered a part of these specifications.



MATERIAL, LABOR, ETC.

The contractor is to furnish, at his own cost and expense, all transportation, labor, material, apparatus, and utensils needed for performing the work in the best possible and most expeditious manner, according to the drawings and specifications.

He shall employ only competent foremen and experienced laborers, and shall discharge immediately, whenever required to do so by the engineer, any man considered by the engineer as incompetent, or disposed to be disorderly, and shall not again employ such person on the work.

INSPECTION:

All material furnished and work done will be inspected by the engineer or his assistants, and if not in conformity with these specifications, will be rejected, and shall be immediately removed and other material furnished and work done in accordance therewith. If the contractor refuses to remove the work and material as above, when ordered, then the engineer shall have the right and authority to stop the work at once, and to supply men and materials to remove and correct the faulty work and materials at the cost and expense of the contractor, such expense to be deducted from any moneys then due, or to become due, to the contractor from the city. The contractor shall furnish all necessary facilities, should



it be advisable to make any examination of the already completed work. If any work or material be found defective in any respect, he shall defray the expense of such examination and satisfactory reconstruction. If all the work or material be found satisfactory, such expense will be paid by the city. The engineer shall have the right to reject, at any time previous to the final settlement with the contractor, any work or material which may be found to be faulty.

#### TIME.

The successful bidder must sign the contract for the work to be done by him, within five days after the contract is awarded to him, and must begin work at such time as is fixed by the engineer, after ten days from the date of awarding the contract. He shall proceed with the work, prosecuting it with due diligence from day to day, at such time, in such places, and with such force as the engineer may, from time to time, direct during the progress of the work, and he must complete the work at or before the time fixed for the completion of it. The work must be fully completed on or before November 1, 1908.

#### INSTRUCTIONS.

The contractor must follow strictly and without delay, all instructions and orders given by the engineer in the



performance of his work. In the event of the contractor's absence from the work, he must leave the work in charge of a duly authorized representative, to whom orders and instructions may be given.

### RESPONSIBILITY.

The contractor will have charge of, and be responsible for the entire work embraced in his contract until completed and accepted by the city, and until the contractor is formally released from his obligations.

He is required not to assign or sublet his contract without written permission from the city, upon the written recommendation of the engineer, and must keep it under his control until completed and accepted, and in case of his absence from the work, must have a duly qualified person to take charge of the same.

This section is not to be construed in such a way as to prevent the city from entering upon the use of the whole or any portion of the work, which may be in condition to use, at any time previous to its final acceptance, and such use is not to be taken as an acceptance by the city of the whole or any part of the work performed under this contract.

### DELAYS.

No charge made by the contractor for any delays or





hindrances from any cause during the progress of any portion of the work embraced in this contract will be allowed. If the delay be caused by any act or neglect of the city, then he will be entitled to an extension of the time allowed for the completion of the work, sufficient to compensate for the delay, to be determined by the engineer, provided the contractor shall give the engineer immediate notice of the cause, in writing. If the contractor fails to complete the work at the date specified, he shall forfeit to the city, as liquidated damages, the sum of Ten (\$10.) Dollars per day for each and every day which the completion of the work embraced in his contract is delayed beyond the time fixed by the contract.

#### CLEARING UP.

Before the work will be considered complete, all rubbish and unused material due to, or connected with the construction, must be removed, and the premises left in a condition satisfactory to the engineer.

All crosswalks, sidewalks, pavement, and other private and public property disturbed or damaged must be restored to their former condition, and final payment will be withheld until such work is finished.

#### DISAGREEMENTS.

Should any disagreement or differences arise as to



the interpretation or true meaning of the drawings or specifications, on any point, the decision of the engineer shall be final, conclusive, and binding to all parties to the contract.

#### CHANGING THE AMOUNT OF WORK.

The city reserves the right, upon the recommendation of the engineer and approval of the mayor, to increase or decrease the amount of work, or any part thereof, to the amount found necessary; also to make any and all changes or modifications in the plans and specifications which may be found to be necessary, or which will be for the betterment of the system, either in whole or in part, provided the same shall not change the general character of the work or increase or decrease the cost of the same more than five (5%) per cent. Any changes in work made in accordance with the foregoing, which will either increase or decrease the cost of the improvement, to the amount of such increase or decrease, will be considered as extra work, and will be paid or deducted for accordingly. No allowance will be made, in case of decrease, for any real or supposed damage, or loss of profit occasioned by such diminution.

The time fixed for the completion of the work will be proportional to the increase or decrease.



### EXTRA WORK.

No extra work will be paid for, or allowed, unless the same is performed upon the written order of the engineer. Subject to this condition, extra work will be paid for according to the schedule of price bid. In case of work not included in the schedule, ten (10%) per cent. upon the actual cost, as determined by the engineer, will be paid to the contractor.

All claims for extra work must be made to the engineer, in writing, before the payment of the next succeeding estimate after the work shall have been performed, and failing to do this, the contractor shall be considered as having abandoned his claim.

### WEATHER.

During unsuitable weather all work must stop when such work would be liable to be injured, and it must be suitably protected from such possible injury.

### CLAIMS.

Before final settlement will be made, the contractor must furnish the city with satisfactory evidence that all persons who have been employed upon the work, or who have furnished material for the work, under his contract and according to these specifications, and who may have been



entitled to a lien, have been fully settled with, and are no longer entitled to a lien. In case such evidence is not furnished, then the city may retain from all moneys due to the contractor, and in possession of the city, such an amount as they may deem necessary to meet all lawful claims due to the above mentioned parties, until such claims are fully discharged and the evidence thereof furnished to the city.

#### DAMAGES.

The contractor will be required by his contract to preserve the city harmless from all claims for damages, from any and all causes whatever, in connection with his work, or any part thereof, during construction and until the same has been accepted by the city.

#### ABANDONMENT.

If the contractor shall abandon his work, under this contract, or if at any time the engineer shall be of the opinion, and shall so certify to the city, that the work, or any part thereof, is unnecessarily delayed, or that the contractor is wilfully violating any of the conditions of the contract, or executing the same in bad faith, then, at the option of the city, the contract may be declared null and void, the security may be forfeited, and the





materials delivered at and built into the work shall be the property of the city. The city may then, at its option, proceed to complete the work, either by day work, or by contract, and any and all damages and increased cost of the work to the city will be deducted from the funds retained by the city, and from any sum realized from the value of the materials reverting to the city.

#### ACCEPTANCE.

A formal inspection of the work will be made by the mayor, engineer, and street committee, within thirty (30) days after the completion of the work. At this time, should any defects or imperfections appear in the whole, or any part of the work, which are caused through any fault or neglect of the contractor, the same must be corrected before the work will be accepted. If not, the work will be accepted at that time.

#### ESTIMATES AND PAYMENTS.

Partial payments will be made monthly, based on the engineer's estimates; such payments to be determined by deducting from the total value of the work done, fifteen (15%) per cent., also all previous charges and payments. The final payment will be made within thirty (30) days after the formal acceptance of the work, as specified.



Partial payments made upon the engineer's estimates, either monthly or otherwise, shall not be construed as a final or partial acceptance of any portion of the work, or as relieving the contractor in any way from the responsibility herein contemplated.

Payment will be made by deposit to the credit of the contractor in the Farmer's and Merchant's Bank, in the city of Jefferson, Wisconsin.

#### PLANS AND SPECIFICATIONS.

The contractor will be furnished with one set of drawings, prints, or tracings, and a set of specifications, giving all the details and dimensions necessary for carrying out the work. Dimensions given in figures will have the preference over the scale where there is any discrepancy. If the contractor does not fully understand the plans or specifications, or is in doubt as to the engineer's ideas or intentions concerning any part of the work, he must satisfy himself concerning the same by inquiry of the engineer before bidding, for he will be held rigidly to the engineer's interpretation of the plans after the contract is drawn. No deviations from the plans and specifications will be allowed, except by written authority of the engineer.



The engineer will give all lines and grades, and the contractor must furnish such assistance as may be required for giving the same.

## M A T E R I A L S.

### SEWER PIPE.

The pipes and specials, not otherwise specified, shall be of the best quality of salt-glazed, vitrified, earthenware sewer pipe, of the hub and spigot pattern. They shall be hard and thoroughly burned, and of smooth and well glazed exterior and interior surfaces. The body of the pipe shall have a uniform thickness of not less than  $1/12$  of the internal diameter. The pipe and specials designed to be straight shall have a maximum deviation from a straight line of not more than  $1/8$  of an inch per foot of length. The diameter shall not vary more than 4% from the nominal diameter. All hubs and sockets must be of sufficient diameter to receive to their full depth the spigot end of the next following pipe or special without any chipping whatever of either, and to leave an annular space of not less than  $1/4$  inch in thickness entirely around the pipe for the cement mortar joint. If deemed necessary by the engineer all pipe shall be fitted and marked before being



lowered into the trench. The depth of sockets for 8-inch pipe shall be not less than  $2\frac{1}{2}$  inches, and for larger sizes not less than 3 inches.

Any pipe or special having fire cracks of a size calculated, in the opinion of the engineer, to injure the pipe will be rejected. All pipe showing transportation, cooling, or frost cracks will be rejected. Irregular lumps or unbroken blisters on the inside of a pipe or special of sufficient size and number to form an appreciable obstruction to the free flow of sewage will be cause for rejection. If a piece be broken out of the hub or socket of a pipe or special, without injuring the body of such pipe, the latter shall be rejected, if the length of such broken piece is greater than  $1/10$  of the circumference of the pipe; or in case the pipe cannot be so placed that above defect may come in the upper part of the sewer.

#### CAST IRON PIPE.

Wherever shown on the plans cast iron pipe shall be used, which shall be of standard size gas pipe, thoroughly coated on both sides with coal tar varnish. The pipe shall be in lengths of 12 feet, except that wherever directed by the engineer half lengths shall be used.





### BRICK.

All brick used in the work shall be hard burned brick, regular in form, and of good quality.

### CAST IRON.

The iron used for castings shall be of good quality, grey iron, tough, and of even grain. If required by the engineer, specimens shall be furnished for testing which shall fulfill the following requirements: The iron shall have a tensile strength of not less than 18,000 pounds per square inch. Test bars of metal, 3 inches by 1/2 inch, when placed upon supports 18 inches apart and loaded in the center shall have a transverse breaking load of not less than 1,000 pounds, and a maximum deflection of not less than 3/8 inch.

### CEMENT.

The cement used shall be American Portland cement of approved brand, and shall be subject to such tests as the engineer may deem necessary.

### SAND.

All sand used in the work shall be clean, sharp sand, and well screened.

### MORTAR.

The mortar used for making the pipe joints shall be



composed of one part, by measure, of cement, and one part, by measure, of sand. The ingredients must be thoroughly mixed dry, and then a moderate amount of water added, and the whole thoroughly worked to a suitable consistency. The mortar used in brickwork shall be composed of one part of cement and three parts of sand, mixed as above stated. The mortar shall in all cases be freshly mixed, and only in sufficient quantities for the work in hand. No mortar shall be used that has begun to set, or that has become hard.

#### CONCRETE.

The concrete used in the work, except as hereinafter specified, shall be composed of one part cement, three parts sand, and six parts broken stone. The broken stone shall be clean, and no piece shall be greater than two inches in diameter. In making the concrete, the mortar shall first be made as in the manner previously stated. The broken stone shall be wetted and then added to the mortar, and the whole worked over until of uniform consistency. After the concrete is mixed it must be rapidly put in place in layers not exceeding six inches in thickness, and thoroughly rammed until the mortar, the surface, and all the interstices are entirely filled.



CONSTRUCTION.EXCAVATION.

The sewer trenching shall be excavated for the entire length thereof, and made on the lines indicated, and of such width and to the grade line as indicated on the accompanying plan and profile, the location of which is shown on the general plan of sewers on file in the office of the city clerk. The materials to be excavated to be deposited on the sides of the trenches, and beyond the reach of slides. No deviations from straight lines will be permitted, except under special direction of the engineer. In excavating through macadam or paving, the surface material shall be taken up and placed separately to one side, and afterwards replaced so as to leave the streets and crossings in as good condition as they were before removal. The engineer may require the macadam, paving, or other surfacing removed from the vicinity and replaced after the sewers are built and the trenches filled. Whenever necessary, in deep cutting, or in unsafe material, timber and plank curbing shall be used to support the sides of trenches. No allowances will be made for curbing unless the same shall be required to remain after the completion of the work, in which case the lumber will be paid for by board measure at market price.



The engineer may limit the length of excavation to be opened at one time, owing to the nature of the soil and other attending circumstances.

The contractor will be required, at his own expense, to remove, if necessary, or if not removed, to sustain by means of timbers or other appliances, all water, sewer, or gas pipes which may in any manner be affected by this work, and do everything necessary to protect, support, and sustain such water, sewer, or gas pipe, and any other fixtures laid along or across the streets, and shall in no wise obstruct the gutters of the street, or in any way prevent the flow of water in the same, and shall use proper means to permit the flow of surface water while the work is progressing. The contractor shall not in any manner unnecessarily obstruct the streets or crossings, and shall at all times and under all circumstances provide safe and sufficient means for foot passengers and steam cars. It shall also be his duty to erect and keep a fence or other proper barrier along the line of work and across the ends of trenches, in order to guard the public effectually from liability to accident during the entire progress of the work, both by day and night, and he will be held responsible for damages arising in consequence of neglecting the proper precautions here specified..





In addition to the necessary barriers, a red light must be maintained at night, from twilight in the evening until sunrise, at each end of the trench, and a watchman shall be employed as additional security whenever the same may be needed.

All surplus earth shall be hauled away and deposited at such places on the line of the work as the engineer shall direct.

#### PIPE LAYING.

The pipes and specials shall be laid to grade as given by the engineer, and in such a manner as he directs. Before laying the pipe, the bottom of the trench shall be carefully cut to the true grade, and holes shall be cut in the bottom to receive the bell of the pipe, which shall be deep enough to readily admit of making the proper joint. If the trench be excavated below the proper grade it shall be brought to the proper grade by filling with fine earth or sand, thoroughly rammed into place. After a joint of pipe is inserted in the bell of the previously laid pipe, a gasket of tarred hemp or oakum shall be introduced between the hub and spigot, and securely caulked in place. The space between the hub and spigot shall then be entirely filled with mortar, thoroughly pressed



in on the bottom, sides and tops, and rammed with a wooden caulking tool. The joint shall then be finished on the outside to a neat bevel. The interior of the joint and pipe shall be cleaned of all mortar and other material; and to insure this, a wad, made of a sack filled with hay or other suitable material, shall at all times be kept in the sewer and pulled forward as each joint is completed. All water must be kept out of the bell hole during laying and until the cement has become set, or until the bell hole has been filled with concrete or earth, as specified. No length of pipe shall be laid until the previous length has had sufficient filling placed about it to hold it securely in place. If, in making any joint, previous lengths are disturbed, such lengths must be uncovered and such joints remade. Wherever required by the engineer, timber foundations shall be put in as directed, to be paid for as extra work.

Wherever shown on the plans, 5-inch "Y" branches will be inserted. Unless connections be made at once, each "Y" shall be closed by an earthenware cap, well cemented in.

Cast iron pipe shall be laid with a hemp gasket and lead joint, properly caulked. The vitrified and iron pipe shall be joined in such manner as shall meet the



approval of the engineer.

### MANHOLES.

Manholes will be built at the points indicated on the general plan, in accordance with the drawings herewith submitted. They will be circular in form (2) two feet interior diameter at the top and (4) four feet at the bottom. They will be constructed on a concrete foundation (6) six inches thick, and (3) three inches larger than the exterior dimensions of the manhole all around.

The foundation having been completed and become sufficiently hardened, the inlet and outlet pipes will be placed in proper position and the brickwork constructed. Each brick will be laid as a header or as specified for flush tanks, as the engineer may elect, in a full bed of cement mortar, preserving a truly circular form throughout.

Both the inside and outside shall be plastered with cement mortar at least  $3/8$ -inch thick.

The manhole ring will be placed in position, and the bottom flange thoroughly bedded in mortar; the cover to be at the proper elevation to conform to the street grade. The manhole ring and cover must be of standard pattern. Steps, as shown by the drawings, will be built



into the brickwork at the proper places.

### LAMPHOLES.

Lampholes or standpipes will be built in the places and in the manner shown by the plans. The lower end of the lamphole and the joint of the sewer at that point shall be thoroughly supported by means of a block of concrete, constructed about the pipe, as shown on the plans. The top of the pipe shall be brought within one foot of the surface, and covered with an iron box of standard pattern, which shall be supported upon a solid block of concrete six (6) inches in thickness.

### BACK-FILLING.

The trench and other excavations shall be refilled with such excavated material, and in such order as may be from time to time directed by the engineer. In covering the sewers and filling around manholes, the earth shall be brought up evenly on both sides so that no unbalanced pressure is brought to bear on the masonry or pipe. As soon as the cementing or concreting of any joint has been completed, loose, fine sand or earth shall be filled around the pipe for one-half its perimeter, and shall be carefully compacted until the pipe has a solid,





uniform bed. The trench shall then be carefully filled with earth or sand, free from stones, to a depth of one foot above the top of the sewer, which filling shall be thoroughly rammed in layers not exceeding four (4) inches in thickness, or where the engineer may direct, water tamping may be used. In marshy soil, or where there is much subsoil water, the trenches must be filled, on both sides of the pipe and for one foot above it, with gravel.

All macadam surfacing stone, flagging, or paving of crosswalks, or gutters, plank crossings, culverts, or other structures, which may have been displaced in constructing the sewer, must be properly relaid to line and grade, and left in as good condition as before being disturbed.

#### INSTRUCTIONS TO BIDDERS.

A lump bid is desired to cover the whole work. To cover any extra work, contractors will name a price for each of the following:-

- A. Price per lineal foot for each size of pipe laid and cemented.
- B. Price, each, for specials of each size of pipe laid and cemented.
- C. Price per lineal foot for excavation and back-



filling for various depths of trench  
from 3 to 12 feet.

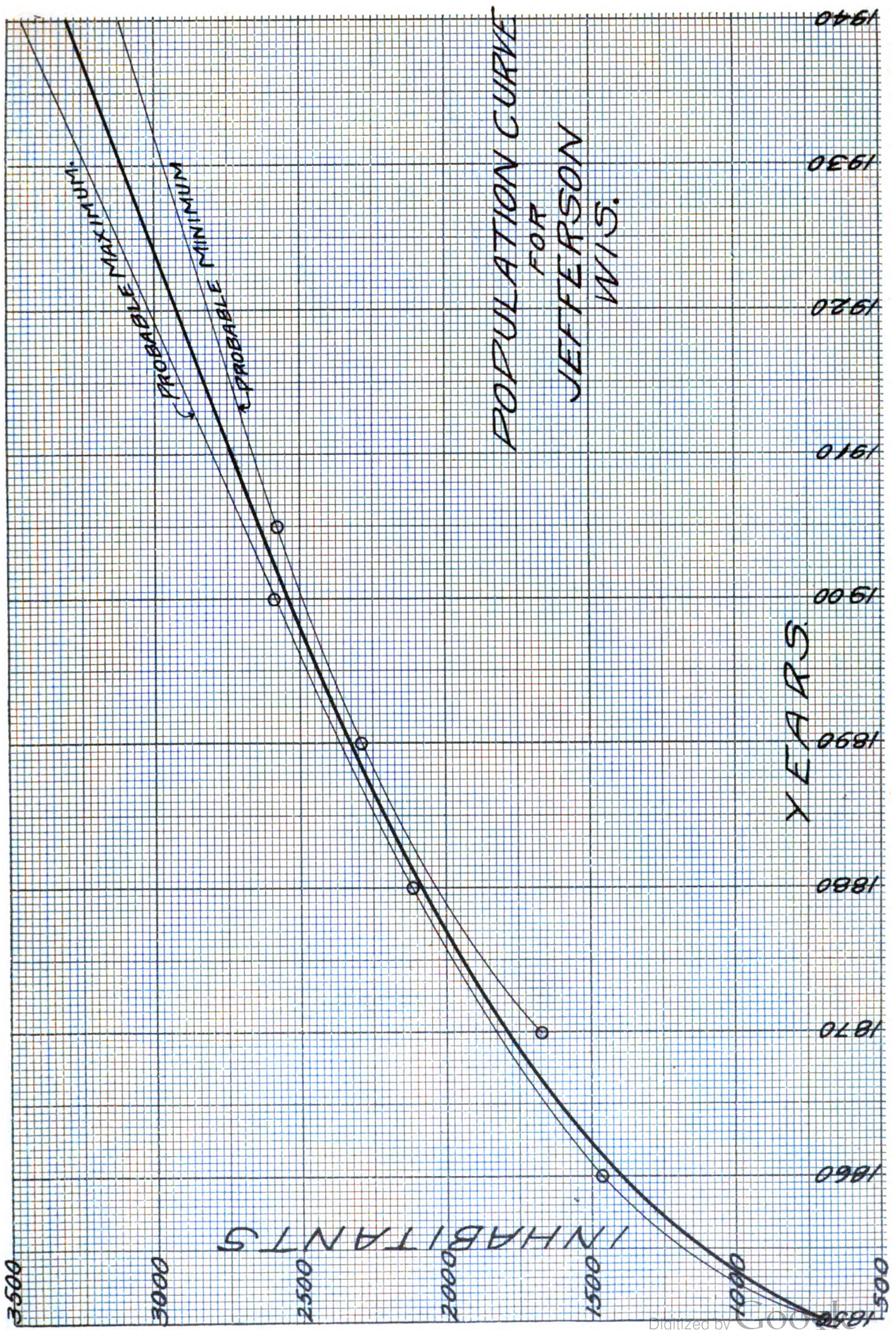
- D. Price of manholes for various depths, complete.
- E. Price of lampholes for various depths, complete.
- F. Price per lineal foot of cast iron pipe, laid  
and caulked.
- G. Price of timber in foundation per 1,000 feet  
B.M.
- H. Price per lineal foot of laying cast iron pipe  
across the rivers on pile bridges.
- I. Price per lineal foot of laying the cast iron  
pipe across the Rock River at First  
Street crossing.
- J. Price per lineal foot of carrying sewer in  
embankment.
- K. Price of flush tanks, complete.

ENGINEER'S ESTIMATE.

The following is the engineer's estimate of materials to be furnished and work to be done. It is merely given as a guide to the contractor, and is intended to be closely approximate, but its accuracy is not guaranteed. The contractor must satisfy himself, by a careful examination of the plans, as to the extent and details of the work.











On	From	Elev. of Invert.	To	Elev. of Invert	Dist.	% Grade.	Pop.Size	Pipe. Cut.	Av. Cut. Lin. Ft.	Est. Cost	Cost.
First	Candise	75.72	Racine	73.70	800	0.25	840	8"	7.5	.65	\$520.
"	Racine	73.70	Milwaukee	72.85	330	"		8"	8.9	.75	248.
"	Milwaukee	72.85	Dodge	71.92	330	"	920	8"	11.9	.94	310.
"	Dodge	71.92	W. Jefferson	71.02	350	"	1000	8"	10.6	.86	301.
"	W. Jefferson	71.02	Washington	70.12	350	"	1050	8"	8.5	.72	252.
"	Washington	70.12	Green	69.20	350	"		8"	8.4	.72	252.
"	Green	69.20	Walworth	68.32	350	"	1620	8"	8.3	.71	249.
Main	Woolcock	89.46	Ogden	86.98	490	0.5	120	8"	6.0	.56	240.
"	Ogden	86.98	North	85.51	290	0.5	360	8"	5.4	.52	151.
"	North	85.51	Candise	83.81	335	0.5	400	8"	6.0	.56	187.
"	Candise		Walworth			Existing Sewer.					
"	Walworth	67.55	Dane	66.65	350	2.5	2220	10"	5.6	.64	224.
"	Dane	66.65	River	65.50	430	.25		10"	5.6	.64	275.
Center	Woolcock	107.86	Ogden	100.02	490	1.6	60	8"	6.8	.61	299.
"	Ogden	100.02	North	109.74	335	2.9	80	8"	8.1	.70	234.
"	North	109.74	Church	112.04	460	0.5	50	8"	6.8	.61	280.





On	From	Elev. of Invert.	To	Mechanics	Elev. of Invert.	%	Dist.	Grade	Pop.	Pipe.	Cut.	Size	Av.	Est. Cost Lin. Ft.
Center	Church													
Third	Racine	105.53	Milwaukee		102.11	340	1.0	50	8"	6.0	.56			\$190.
"	Milwaukee	102.11	Dodge		90.19	340	3.5	90	8"	6.3	.58			197.
"	Dodge	90.19	Linden		84.73	340	1.6	110	8"	6.6	.59			200.
"	Linden	84.73	Washington		79.26	340	1.6	120	8"	6.5	.59			200.
"	Washington	79.26	Green		75.79	345	1.0	130	8"	5.5	.53			183.
"	Green	75.79	Walworth		72.31	345	1.0	150	8"	6.3	.58			200.
"	Walworth	72.31	Dane		68.89	340	1.0	170	8"	5.6	.53			180.
Sanborn	Woolcock	120.11	Ogden		135.30	490	3.1	80	8"	6.7	.60			294.
"	Ogden	135.30	North		137.00	335	0.5	20	8"	5.7	.54			181.
"	North	134.92	Church		122.02	460	2.8		8"	7.2	.64			294.
"	Church	122.02	Racine		101.00	525	4.0	50	8"	7.2	.64			342.
Fourth	Racine	96.80	Milwaukee		92.01	340	1.4	600	8"	11.1	.88			300.
"	Milwaukee	92.01	Dodge		87.23	340	1.4	630	8"	7.9	.68			231.
"	Dodge	87.23	Linden		81.69	345	1.6	670	8"	6.6	.60			207.
"	Linden	81.69	Washington		76.22	340	1.6	680	8"	6.4	.59			200.
"	Washington	76.22	Green		74.47	345	0.5	700	8"	5.9	.56			193.



On	From	Elev. of		To	Elev. of		%	Dist.	Pop.	Pipe.	Cut.	Est. Cost	
		Invert	Top		Invert	Top						Av. Cost	Lin. Ft. Cost.
Fourth	Green	74.47	Walworth		72.72	345	0.5	700	8"	5.6	.53	\$183.	
"	Walworth	72.72	Dane		71.00	340	0.5	710	8"	5.3	.51	173.	
Park	North	138.97	Church		119.21	470	4.2	50	8"	5.8	.55	264.	
West	North	132.10	Church		127.48	460	1.0			6.3	.58	278.	
Church	Park	119.21	German		118.19	200	0.5		8"	8.8	.74	148.	
German	Church	118.19	Racine		98.74	525	3.7	120	8"	8.9	.75	394.	
Darling	North	130.68	Church		125.07	465	1.2	40	8"	6.2	.57	265.	
"	Church	125.07	Racine		103.00	525	4.2	90	8"	6.2	.57	299.	
Marion	North	132.71	Church		130.85	460	0.4	40	8"	7.4	.65	300.	
"	Church	130.85	Racine		118.23	525	2.4	100	8"	10.1	.83	435.	
Dewey	North	138.97	Church		136.64	460	0.5	10	8"	6.9	.62	285.	
"	Church	136.64	Racine		130.32	525	1.2	40	8"	7.8	.68	357.	
Woolcock	Sanborn	109.51	Center		97.49	600	2.0	40	8"	9.4	.78	468.	
"	Center	97.49	Main		89.46	400	2.0	60	8"	10.8	.87	348.	
Ogden	Sanborn	136.00	Center		100.02	600	6.0	50	8"	6.4	.58	348.	
"	Center	100.00	Main		86.98	400	3.25	210	8"	8.4	.71	284.	



On	From	Elev. of Invert	To	Elev. of Invert	Dist.	% Grade.	Pop.	Size.	Av. Est. Pipe.Cut.Lin.F. 8" 5.6 .53 \$180.	Cost
Church	Sanborn	122.02	West	127.48	340	1.6				\$180.
Racine	Dewey	130.32	Marion	118.23	335	3.6	60	8"	7.0 .62	\$208.
"	Marion	118.23	Darling	103.00	335	4.6	200	8"	6.0 .56	187.
"	Darling	100.35	German	98.74	530	0.3	330	8"	5.2 .51	270.
"	German	98.74	Sanborn	97.62	365	0.3	490	8"	6.4 .58	212.
"	Sanborn	97.62	Fourth	96.80	264	0.3	520	8"	11.8 .93	246.
"	Center	108.04	Fourth	104.00	335	1.2	50		6.3 .58	195.
Walworth	First	68.32	Main	67.55	300	.25	1620	8"	4.8 .55	165.
Dane	Fifth	72.82	Fourth	71.00	300	0.6	30	8"	5.1 .50	150.
"	Fourth	71.00	Third	68.89	350	0.6	750	8"	5.0 .49	172.
"	Third	68.89	Second	66.65	370	0.6	920	8"	4.8 .48	197.
Clarke	Fair Grds.	83.97	Marshall	82.70	500	0.25	10	8"	8.3 .70	350.
"	Marshall	82.70	Pleasant	81.97	300	0.25	20	8"	16.0 1.22	366.
"	Pleasant	81.97	High	81.17	310	0.25	80	8"	11.6 .90	279.
Washington	Marshall	100.00	Pleasant	97.00	300	1.0	10	8"	6.0 .56	168.
"	Pleasant	88.19	High	79.72	328	2.86		8"	7.7 .67	220.



On	From	Elev. of Invert	To	Elev. of Invert	Dist.	% Grade.	Pop.	Size Pipe.	Av. Cut.	Est. Cost Lin. Ft.	Cost.
Washington	Third	100.44	Second	101.79	320	0.4	40	8"	6.7	.60	\$192.
B	Fifth	86.60	Fourth	95.50	330	4.7	20	8"	7.6	.66	218.
"	Fourth	101.30	Third	111.40	330	9.8		8"	5.8	.55	182.
"	Second	104.34	First	86.32	220	8.2	25	8"	7.0	.62	137.
C	Second	106.07	First	84.05	220	10.0	25	8"	7.5	.66	145.
E	Fifth	74.36	Fourth	73.48	340	0.25	70	8"	8.3	.71	241.
"	Fourth	73.48	Third	72.61	340	0.25	150	8"	14.1	1.10	374.
"	Third	72.61	First	71.81	310	0.25	220	8"	11.5	.91	282.
Fifth	B	86.60	C	85.26	330	0.4	40	8"	7.2	.63	208.
"	C	85.26	E	74.36	680	1.6	50	8"	7.3	.64	435.
Pleasant	Clarke	95.61	Washington	99.00	565	0.6	60	8"	6.8	.61	344.
"	Washington	88.19	A	90.00	712	0.25	25	8"	8.5	.78	555.
Fourth	B	95.53	C	114.64	330	5.79		8"	8.0	.69	228.
"	C	114.64	D	95.71	310	5.1		8"	7.6	.66	205.
"	D	95.71	E	73.48	364	6.1	70	8"	10.8	.87	316.





On	From	Elev. of Invert	To	Elev. of Invert	% Dist.	Grade.	Pop.	Pipe.	Cut.	Lin.	Cost.
High	Clarke	81.17	Washington	79.72	564	0.25	130	8"	2.4	.47	\$264.
	Washington	79.72	M.H.#7	80.62	350	0.25)	110	8"	2.7	.47	165.
	M.H.#7	80.62	A	100.44	360	5.5)		8"	6.2	.57	
Third	A	100.44	B	110.80	330	3.25	30	8"	6.8	.61	205.
"	B	110.80	C	121.38	325	3.25			7.8	.68	221.
"	C	121.38	D	98.84	310	7.2	20	8"	5.7	.54	167.
"	D	98.84	E	72.61	364	7.2	45	8"	10.1	.82	298.
Second	A	106.79	B	103.09	330	0.4	15	8"	9.0	.75	248.
First	B	86.32	C	84.05	320	0.7	65	8"	7.5	.66	211.
"	C	84.05	D	81.72	330	0.9	150	8"	7.3	.64	211.
"	D	81.72	E	71.81	380	2.6	170	8"	7.4	.65	247.
"	E	71.81	Manhole#2	71.11	340	0.2	450	8"	6.4	.59	200.
Hill	M.H.#H	110.20	First	101.53	170	5.1			8.0	.69	117.
Hill	First	101.53	Ft.Atk'n R.	94.70	330	5.1	10	8"	8.5	.72	237.
Center	Second	93.64	First	90.01	300	1.2		8"	6.5	.59	177.



On	From	Elev. of Invert	To	Elev. of Invert	% Dist. Grade.	Pop.	Size Pipe.	Av. Est. Cut. Lin. Cost. Ft.	34 Est. Cost
Center	First	90.01	Ft. Atk'n R.	86.03	330	1.2	30	8" 5.4	.52 \$172.
Ft. Atk'n R.	Hill	94.70	Center	86.03	340	2.56		8" 7.5	.78 265.
Center		86.03	Manhole #6	80.20	415	1.4		8" 6.7	.60 249.
M.H. #6		80.20	M.H. #5	73.87	450	1.4		8" 7.2	.64 288.
M.H. #5		73.87	M.H. #4	73.04	400	0.2		8" 4.6	.47 188.
M.H. #4		73.04	M.H. #3	72.02	500	0.2	120	8" 2.3	.47 235.
M.H. #3		72.02	M.H. #2	71.29	100	0.2		8" 4.0	.40 40.
M.H. #2		71.29	M.H. #1	71.04	100	0.25		Emb. .40	40
Siphon				40				4.0	.40 <u>160.</u>
									\$24,655.00
Darling	First	78.37	Eliz.	77.60	300	0.25	25	10.2	.83 249.00
Eliza.		77.60	Walters	78.32	280	0.25	300	13.8	1.07 302.00
Walters		78.32	High	79.72	550	0.25			
Elizabeth	Darling	77.60	Candise	76.75	285	0.25	350	13.2	1.03 294.00
Candise	Main	83.81	First	75.72	335	2.5	420	6.6	.60 201.00
"	First	75.72	Eliz.	76.75	405	0.25	420	7.6	.66 267.00



To	From	Elev. of Invert	To	Elev. of Invert.	%	Av. Cost Cut. Lin. Ft.	Est. Cost.	35
Candise	Elizabeth	76.75	Walters	77.70	325	0.25	40 4.6 .47	\$153.00
	M.H.#9	70.44	Walworth	68.32	890	.25	4.0 .40	356.00
<div style="text-align: right;">Total - - - - -</div>								\$26,477.00



MANHOLES, LAMPHOLES, AND FLUSH TANKS.

Intersection with	Elevation of Bottom.	Elevation of Top.	Depth.
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WALTERS STREET.

Darling	78.32	84.2	5.9
L.H.Candise	77.70	78.8	1.1

ELIZABETH STREET.

Darling	77.60	94.9	17.3
Candise	76.75	83.7	7.0

FIRST STREET.

L.H. Darling	78.37	84.2	5.8
Candise	75.72	83.5	7.8
Mechanics	74.7	82.2	7.5
Racine	73.70	81.8	8.1
Milwaukee	72.85	83.7	10.9
Dodge	71.92	85.0	13.1
W.Jefferson	71.02	80.4	9.4
Washington	70.12	79.3	9.2
Green	69.20	78.0	8.8
Walworth	68.32	76.0	7.7

MAIN STREET.

Woolcock	89.46	96.3	6.8
Ogden	86.98	92.3	6.3
North	85.51	90.6	5.1
Candise	83.81	90.5	6.7
Walworth	67.55	74.3	6.8
Dane	66.65	71.0	4.4

CENTER & THIRD STREETS.

Woolcock	107.86	97.49	113.8	6.0
Ogden	100.02		110.3	10.3





MANHOLES, LAMPHOLES, AND FLUSH TANKS.

Intersection with	Elevation of Bottom.	Elevation of Top.	Depth.
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CENTER & THIRD STREETS, Cont'd.

North	109.74	116.9	7.2
Church	112.04	117.4	5.4
Racine	105.53	108.04 111.6	6.1
Milwaukee	102.11	108.6	4.5
Dodge,	90.19	96.5	6.3
Linden Ave.	84.73	92.1	7.4
Washington	79.26	84.8	5.5
Green	75.79	81.5	5.7
Walworth	72.31	78.4	6.1

WEST STREET.

L.H. North	132.10	137.2	5.1
Church	127.48	134.0	6.5

FOURTH STREET.

Racine	96.80	111.00	14.2
Milwaukee	92.01	101.4	9.4
Dodge	87.23	93.6	6.4
Linden Ave.	81.69	89.3	7.6
Washington	76.22	82.6	6.4
Green	74.47	80.0	5.5
Walworth	72.72	78.2	5.5
Dane	71.00	76.0	5.0

SANBORN STREET.

Woolcock	109.51	125.6	16.1
Ogden	135.30	141.0	5.7
North	134.92	141.3	6.4
Church	122.02	128.6	6.6
Racine	97.62	106.5	8.9



MANHOLES, LAMPHOLES, AND FLUSH TANKS.

Intersection with	Elevation of Bottom.	Elevation of Top.	Depth.
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GERMAN STREET.

Church	118.19	129.8	11.6
Racine	98.74	103.3	4.6

PARK STREET.

L.H.North	138.97	146.4	7.4
Church	119.21	125.1	5.9

DARLING STREET.

L.H.North	130.68	136.4	5.7
Church	125.07	130.7	5.6
Racine	103.00	109.1	6.1

MARION STREET.

L.H.North	132.71	138.1	5.4
Church	130.85	140.1	9.3
Racine	118.23	126.0	7.8

DEWEY STREET.

L.H.North	138.97	144.1	5.1
Church	136.64	144.7	8.1
Racine	130.32	136.0	5.7

W E S T   O F   R O C K   R I V E R .  
MANHOLES ON FIRST STREET.

B	86.32	95.5	9.2
C	84.05	90.4	6.4
D	81.72	88.8	7.1
E	71.81	80.5	8.7
M.H.#2	71.11	75.8	4.7



W E S T   O F   R O C K   R I V E R .MANHOLES ON SECOND STREET.

Intersection with	Elevation of Bottom.	Elevation of Top.	Depth.
A	101.79	107.6	5.8
B	103.09	109.4	6.3
L.H.C	106.07	113.7	7.6

HIGH OR THIRD STREET.

Clarke	81.17	86.1	4.9
Washington Ave	79.72	80.2	.5
M.H.#7	80.62	86.9	6.3
A	100.44	104.9	4.5
B	110.80	117.1	6.3
C	121.38	127.3	5.9
D	98.84	105.2	6.4
E	72.61	87.6	5.0

PLEASANT OR FOURTH STREET.

Clarke	81.97	99.7	7.7
Washington Ave.	88.19	103.0	14.8
F.T.A	90.0	93.2	3.2
B	95.50	101.2	5.7
C	114.64	119.7	5.1
D	95.71	105.3	9.6
E	73.48	85.2	11.7

MARSHALL STREET.

Clarke	82.70	95.3	12.6
L.H.Washington Ave.	100.00	106.0	6.0

FIFTH STREET.

B	86.60	92.1	5.5
L.H.C	85.26	94.8	9.5
E	74.36	79.9	5.5



# S O U T H   O F   C R A W F I S H   R I V E R .

Intersect.with   Elev.of Bot.   Elev.of Top.   Depth.  
MANHOLES ON HILL STREET.

Ft. Atkinson Road	94.70	106.6	11.9
First	101.53	121.1	9.6
L.H.M.H. 11	110.20	127.8	17.6

## C E N T E R   S T R E E T .

Ft. Atkinson Road	86.03	92.1	6.1
First	90.01	96.2	6.2
L.H. Second	93.64	96.8	3.2

## F T . A T K I N S O N   R O A D .

M.H.#6	80.2	87.0	6.8
M.H.#5	73.87	81.4	7.5
M.H.#4	73.04	75.6	2.6
M.H.#3	72.02	75.6	3.6

## F I F T H   S T R E E T ,   -   E A S T   O F   R I V E R .

L.H. Dane	72.82	78.8	6.0
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## C L A R K E   S T R E E T ,   -   W E S T   S I D E   O F   R I V E R .

F.T. Fair Grounds	83.97	88.6	4.6
F.T.M.H.1,			

13	Lampholes, at \$10.00,	- - - - -	\$130.00
3	Flush Tanks, at \$65.00,	- - - - -	195.00
85	Manholes, at \$35.00,	- - - - -	-2,975.00
			<u>\$3,300.00</u>

560 ft. 6" C.I. Pipe, River Crossing at		
Darling St., at \$1.00	- - - - -	\$560.00
250 ft. 6" C.I. Pipe, River Crossing at		
Ft. Atkinson Road, at \$1.00,	- - -	250.00
240 ft. 6" C.I. Pipe, Crossing at 1st St. at \$2.	- - -	480.00
		<u>\$1,290.00</u>





1	Vertical, 1 H.P. Induction Motor,	
	1750 R.P.M.,geared down to 200 R.P.M.,-	\$100.00
1	- 4" Vertical Centrifugal Pump, - - - - -	75.00
	Pumping Station,complete,with well, - - -	225.00
		<u>\$400.00</u>

Sewer pipe, laying, etc., - - - - -	\$26,477.00
Manholes, Flush Tanks, and Lampholes, - - - -	3,300.00
Cast Iron Pipe,and laying, - - - - -	1,290.00
Pumping Plant, - - - - -	400.00
Engineering and Contingencies, 10%, - - - - -	3,150.00

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T O T A L - - - - -	\$34,617.00
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APPROVED:

Daniel M. Wheat

Prof. Hyd. & San. Eng.

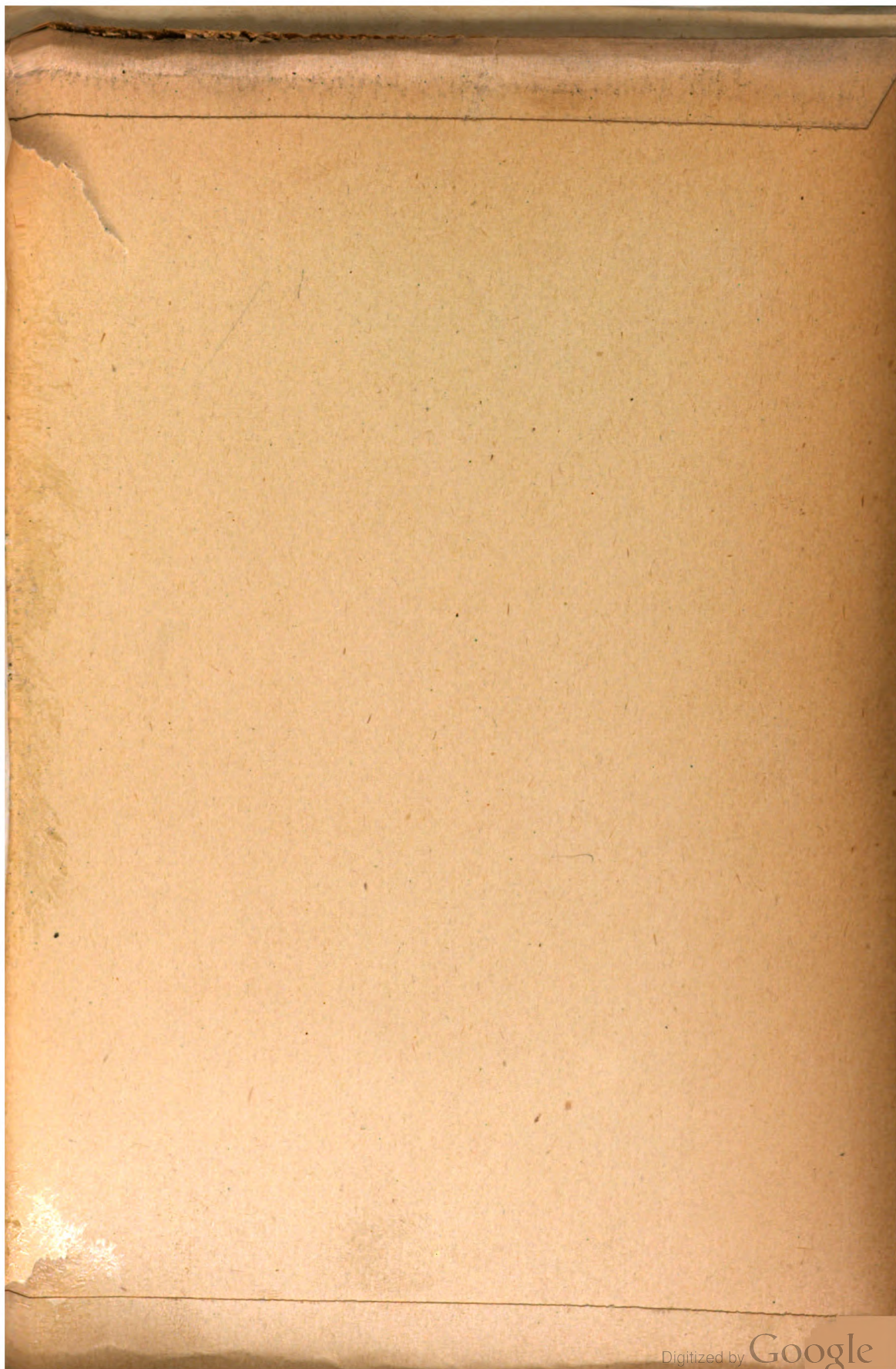
Apr 29th 1908













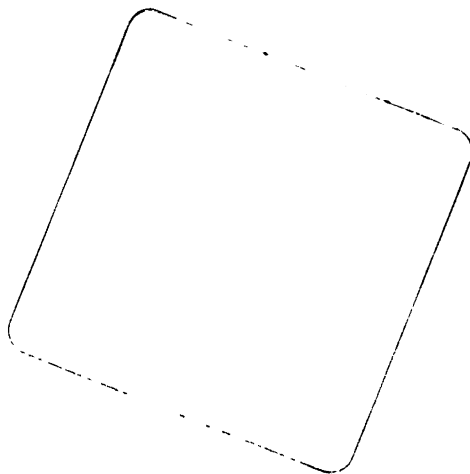




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